Message

From: GeneConvene Virtual Institute [contact@geneconvenevi.org]
Sent: 3/22/2022 5:09:00 AM
To: Kirk, Cassandra [kirk.cassandra@epa.gov]
Subject: Nice review article on Wolbachia and Gene Drive approaches to vector control; Modeling gene drives in Africa

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03/22/2022

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GENE CONVENE GLOBAL COLLABORATIVE Virtual Institute

Sharing knowledge to facilitate understanding of gene drive and other genetic biocontrol technologies

Gene Drive & Genetic Biocontrol Newsletter

March 22, 2022

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Genetic biocontrol, also known as genetic pest management and genetic control, is an active research space. Here we have aggregated research and media reports that have appeared since the previous Newsletter.

GeneConvene Global Collaborative Webinars

Registration

NOTE: Atypical Time!!

THURSDAY March 24, 2022

11:00-12:30 EST

Daven Presgraves, Ph.D.

University of Rochester

Selfish genes, sex chromosomes, and speciation in Drosophila

Registration

New Video

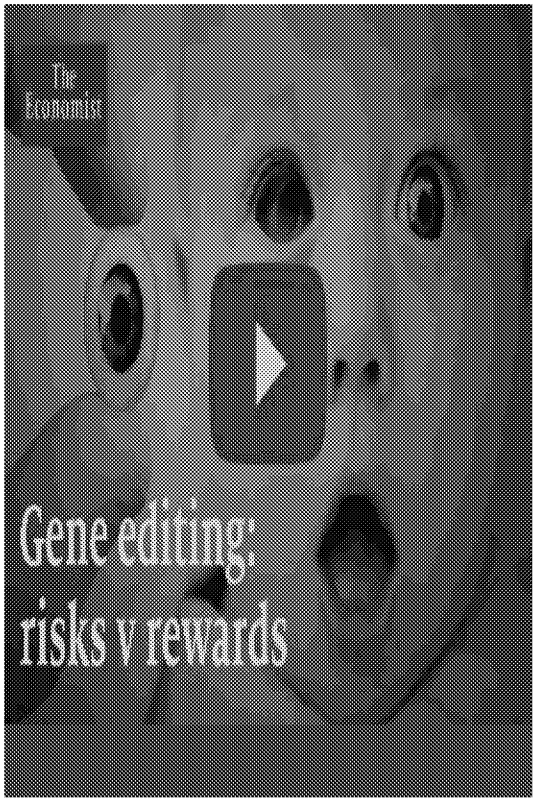
Upcoming Meeting!

Gordon Research Conference

The power of gene editing

The Economist

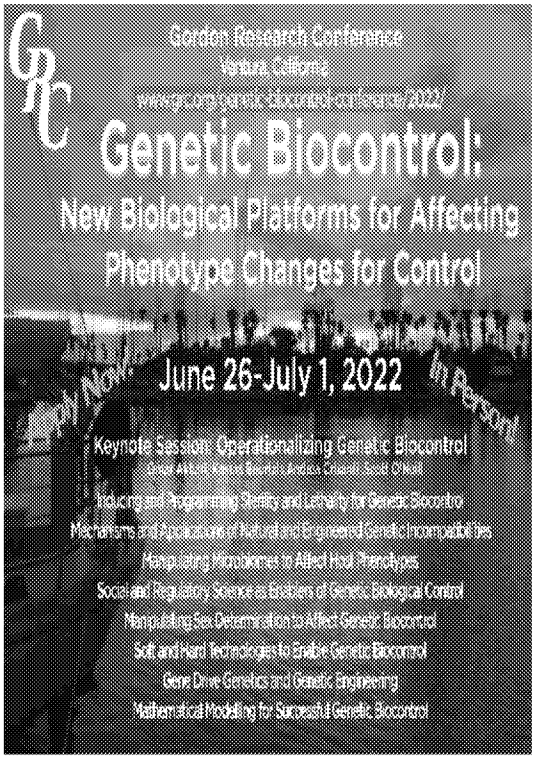
Technologies such as genetic modification and 'CRISPR' will cure hereditary diseases, produce disease-resistant crops and enable the breeding of malaria-free mosquitos. But advances bring ethical and practical dilemmas. Genetically modified food is banned in the EU, and doctors worry that screening for genetic diseases may pave the way for more controversial uses, such as creating so-called designer babies. This film looks at the risks and rewards of gene editing. Gene drive technologies are considered



GENETIC BIOCONTROL

June 26-July 1, 2022

In-Person; Ventura, California



A convening of world-experts to share the latest results, technologies, and best practices.

New Research and Scholarship

Review Article

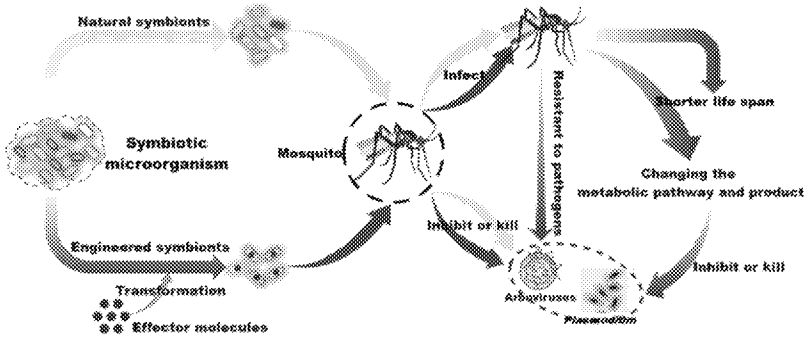
3/18/2021

Symbionts and gene drive: two strategies to combat vector-borne disease

Wang, G.-H., Du, J., Chu, C. Y., Madhav, M., Hughes, G. L. and Champer, J.

Trends in Genetics

https://doi.org/10.1016/j.tig.2022.02.013



Mosquitoes bring global health problems by transmitting parasites and viruses such as malaria and dengue. Unfortunately, current insecticide-based control strategies are only moderately effective because of high cost and resistance. Thus, scalable, sustainable, and cost-effective strategies are needed for mosquito-borne disease control. Symbiont-based and genome engineering-based approaches provide new tools that show promise for meeting these criteria, enabling modification or suppression approaches. Symbiotic bacteria like Wolbachia are maternally inherited and manipulate mosquito host reproduction to enhance their vertical transmission. Genome engineering-based gene drive methods, in which mosquitoes are genetically altered to spread drive alleles throughout wild populations, are also proving to be a potentially powerful approach in the laboratory. Here, we review the latest developments in both symbionts and gene drive-based methods. We describe some notable similarities, as well as distinctions and obstacles, relating to these promising technologies.

Ecological Impacts of Genetic Biocontrol

3/16/2022

Could species-focused suppression of Aedes aegypti, the yellow fever mosquito, and Aedes albopictus, the tiger mosquito, affect interacting predators? An evidence synthesis from the literature

Bonds, J. A. S., Collins, C. M. and Gouagna, L.-C.

Pest Management Science

https://doi.org/10.1002/ps.6870

Abstract The risks of Aedes aegypti and Aedes albopictus nuisance and vector-borne diseases are rising and the adverse effects of broad-spectrum insecticide application has promoted species-specific techniques, such as sterile insect technique (SIT) and other genetic strategies, as contenders in their control operations. When specific vector suppression is proposed, potential effects on predators and wider ecosystem are some of the first stakeholder questions. These are not the only Aedes vectors of human diseases, but are those for which SIT and genetic strategies are of most interest. They vary ecologically and in habitat origin, but both have behaviourally human-adapted forms with expanding ranges. The aquatic life stages are where predation is strongest due to greater resource predictability and limited escape opportunity. These vectors' anthropic forms usually use ephemeral water bodies and .....

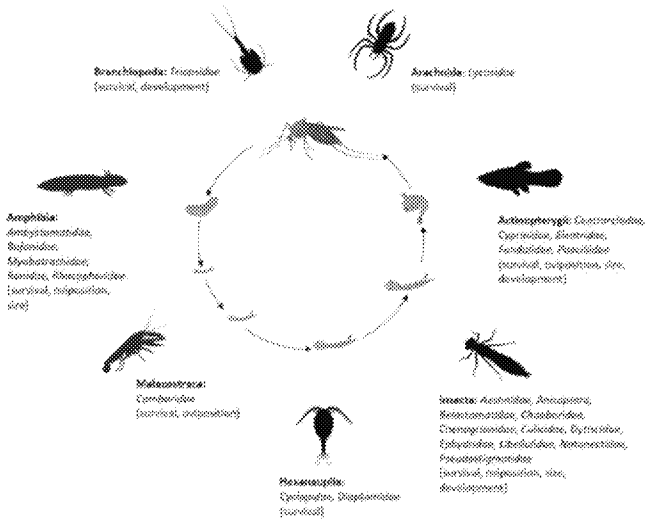


image from: Frentui (2017) doi 10.7554/eLife.71503

2/15/2022 Adult mosquito predation and potential impact on the sterile insect technique

Bimbilé Somda, N. S., Maïga, H., Mamai, W., Bakhoum, T., Wallner, T., Poda, S. B., et al.

Scientific Reports

https://doi.org/10.1038/s41598-022-06565-1

The sterile insect technique is a promising environmentally friendly method for mosquito control. This technique involves releasing laboratory-produced sterile males into a target field site, and its effectiveness may be affected by the extent of adult mosquito predation. Sterile males undergo several treatments. Therefore, it is vital to understand which treatments are essential in minimizing risks to predation once released. The present study investigates the predation propensity of four mantis species (Phyllocrania paradoxa, Hymenopus coronatus, Blepharopsis mendica, Deroplatys desiccata) and two gecko species (Phelsuma standingi, P. laticauda) on adult Aedes aegypti, Ae. albopictus and Anopheles arabiensis mosquitoes in a laboratory setting. First, any inherent predation preferences regarding mosquito species and sex were evaluated. Subsequently, the effects of chilling, marking, and irradiation, on predation rates were assessed. The selected predators effectively .....

Wolbachia Anti-Pathogen Effect

3/16/2022

Differential viral RNA methylation contributes to pathogen blocking in Wolbachia-colonized arthropods

Bhattacharya, T., Yan, L., Crawford, J. M., Zaher, H., Newton, I. L. G. and Hardy, R. W.

PLoS Pathog

https://doi.org/10.1371/journal.ppat.1010393

Arthropod endosymbiont Wolbachia pipientis is part of a global biocontrol strategy to reduce the replication of mosquito-borne RNA viruses such as alphaviruses. We previously demonstrated the importance of a host cytosine methyltransferase, DNMT2, in Drosophila and viral RNA as a cellular target during pathogen-blocking. Here we report a role for DNMT2 in Wolbachia-induced alphavirus inhibition in Aedes species. Expression of DNMT2 in mosquito tissues, including the salivary glands, is elevated upon virus infection. Notably, this is suppressed in Wolbachia-colonized animals, coincident with reduced virus replication and decreased infectivity of progeny virus. Ectopic expression of DNMT2 in cultured Aedes cells is proviral, increasing progeny virus infectivity, and this effect of DNMT2 on virus replication and infectivity is dependent on its methyltransferase activity. Finally, examining the effects of Wolbachia on modifications of viral RNA by LC-MS show a decrease in the amount of 5-methylcytosine modification consistent with the down-regulation of DNMT2 in Wolbachia colonized mosquito cells and animals. Collectively, our findings support the conclusion that disruption of 5-methylcytosine modification of viral RNA is a vital mechanism operative in pathogen blocking. These data also emphasize the essential role of epitranscriptomic modifications in regulating .....

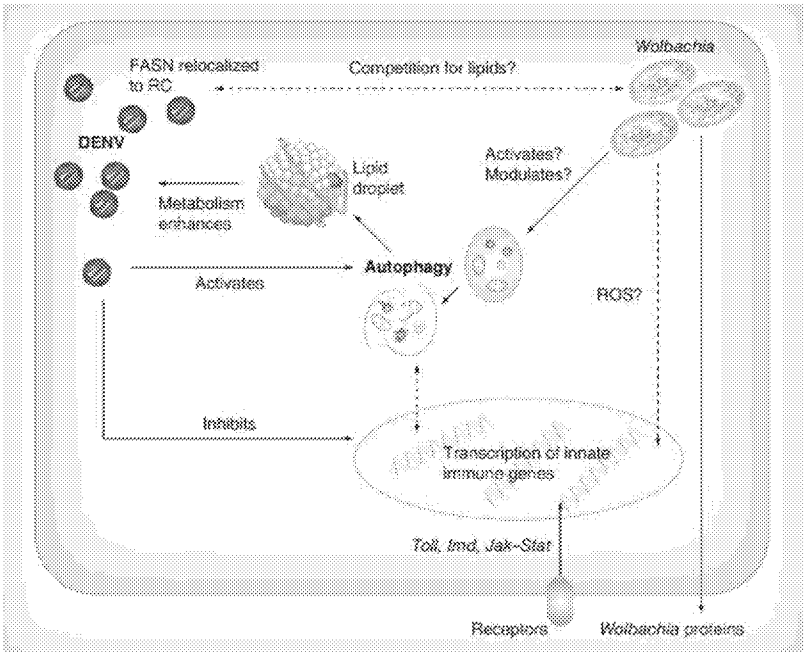


image from: Sinkins (2013) doi.10.2217/fmb.13.95

Modeling Gene Drives

3/18/2022

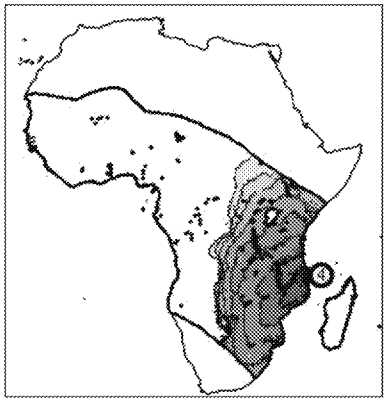
Spatial modelling for population replacement of mosquito vectors at continental scale

Beeton, N. J., Wilkins, A., Ickowicz, A., Hayes, K. R. and Hosack, G. R.

bioRxiv

https://doi.org/10.1101/2021.10.06.463299

Malaria is one of the deadliest vector-borne diseases in the world. Researchers are developing new genetic and conventional vector control strategies to attempt to limit its burden. Novel control strategies require detailed safety assessment to ensure responsible and successful deployments.



Anopheles gambiae sensu stricto (s.s.) and

Anopheles coluzzii, two closely related subspecies within the species complex Anopheles gambiae sensu lato (s.l.), are among the dominant malaria vectors in sub-Saharan Africa. These two subspecies readily hybridise and compete in the wild and are also known to have distinct niches, each with spatially and temporally varying carrying capacities driven by precipitation and land use factors.We model the spread and persistence of a population-modifying gene drive system in these subspecies across sub-Saharan Africa by simulating introductions of genetically modified mosquitoes across the African .....

3/15/2022 Modelling homing suppression gene drive in haplodiploid organisms

Liu, Y. and Champer, J.

bioRxiv

https://doi.org/10.1101/2021.10.12.464047

Gene drives have shown great promise for suppression of pest populations. These engineered alleles can function by a variety of mechanisms, but the most common is the CRISPR homing drive, which converts wild-type alleles to drive alleles in the germline of heterozygotes. Some potential target species are haplodiploid, in which males develop from unfertilized eggs and thus have only one copy of each chromosome. This prevents drive conversion, a substantial disadvantage compared to diploids where drive conversion can take place in both sexes. Here, we study homing suppression gene drives in haplodiploids and find that a drive targeting a female fertility gene could still be successful. However, such drives are less powerful than in diploids and suffer more from functional resistance alleles. They are substantially more vulnerable to high resistance .....

More Research and Scholarship in the Virtual Institute

New Media Coverage

3/19/2022 Squashing malaria could save as many lives as covid-19 has taken

Anonymous

The Economist

https://www.economist.com/graphic-detail/2022/03/19/squashing-malaria-could-save-as-many-lives-as-covid-19-has-taken
When it comes to covid-19 vaccines, poor countries in Africa have been stuck at the back of the queue. However, the continent's long wait for another immunological miracle appears to be drawing to a close. Later this year, the world's .....

3/16/2022 Studying the active role of the maize B chromosome in the modulation of gene expression
University of Missouri
Phys Org
https://phys.org/news/2022-03-role-maize-chromosome-modulation-gene.html
A team of University of Missouri biologists has made a new discovery that provides novel insights into the function and properties of the maize B chromosome. The study was led by Dr. Xiaowen Shi and Dr. Hua Yang, postdoctoral fellows .....

3/16/2022 Billions of GE Mosquitoes May Soon Be Released in California and Florida
Mitra, A. N.
Earth Island Journal
https://www.earthisland.org/journal/index.php/articles/entry/billions-of-ge-mosquitoes-may-soon-be-released-in-california-and-florida/
he US Environmental Protection Agency's decision last week to allow the release of billions of genetically engineered mosquitoes in California and Florida has several environmental and public health groups worried about the potential impacts of the experimental releases on public .....

3/15/2022 Fall armyworms with offspring-killing gene tested on farms in Brazil
Le Page, M.
New Scientist
https://www.newscientist.com/article/2312341-fall-armyworms-with-offspring-killing-gene-tested-on-farms-in-brazil/
Fall armyworms genetically modified to wipe out wild populations of the pests have been released in corn fields in São Paulo State in Brazil in the first farm trial of the new technology. The test was a success and is .....

3/15/2022 California's first lab-grown mosquitoes may take flight—stirring controversy
Krieger, L. M.
Phys Org
https://phys.org/news/2022-03-california-lab-grown-mosquitoes-flightstirring-controversy.html
A biotech firm is seeking permission to release genetically modified mosquitoes into the open air of California for the first time later this year, aiming to reduce the expanding populations of invasive mosquitoes and prevent deadly disease. The controversial research .....

3/14/2022 Genetically modified mosquitoes kill their own offspring
Ward, C.

SYFY
https://www.syfy.com/syfy-wire/genetic-modification-killing-mosquitos-before-theyre-born
Oxitec, a biotech company, has developed a strain of A. aegypti which they call Friendly. Their modified mosquitos are all males and carry a gene which prevents the birth of females in subsequent generations. In short, they're reducing disease-carrying mosquitos .....

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